WASTE MANAGEMENT

Natural Gas Technology For Solid Waste Collection:

Results of Two Waste Management Demonstration Projects and Future Applications

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Introduction: In 1995, Waste Management initiated the first of two pilot projects to determine if 100% natural gas vehicles could meet the demanding needs of the refuse industry. This paper briefly describes the history and results of projects in Palm Desert, California and Washington, Pennsylvania.

The Palm Desert project involved the deployment of fourteen 100% compressed natural gas collection trucks, and the construction of a new CNG fueling station in a region with a severe air quality problem and an economy highly dependent on tourism and agriculture.

In Washington, Pennsylvania, Waste Management and a consortium of public and private entities set out to determine if natural gas – an abundant and domestically produced resource – represented a viable and clean alternative to diesel fuel. Waste Management placed seven 100% liquefied natural gas trucks into service and constructed a new on-site LNG fueling station.

Following is a brief summary of these two groundbreaking projects and an update on new natural gas projects that are now being implemented by Waste Management in more than a dozen locations.

The Palm Desert CNG Demonstration Project: In 1995, the City of Palm Desert first approached Waste Management of the Desert about initiating a demonstration project using 100% compressed natural gas vehicles for solid waste collection in the Coachella Valley. With grant support from the South Coast Air Quality Management District, Waste Management was able to introduce 14 heavy-duty CNG trucks – six new trucks and eight re-powers – into its existing hauling fleet during the period July 1995 through December 1998.

The eight re-powered vehicles were equipped with "first generation" Cummins L10-300G natural gas engines. Initially, the Company experienced substantial downtime due to the failure of high-pressure regulators, actuators, spark plugs and the electronic control system. These problems were largely overcome as a result of improved or modified components, training of maintenance personnel and new computer analysis software. Waste Management received excellent technical support from Cummins Engine Company and NGV Ecotrans throughout the demonstration project.

Driver acceptance of the CNG trucks has been excellent due to the reduced emissions, reduced noise and the convenient, slow-fill refueling station constructed at the Palm Desert facility by Pickens Fuel Corporation. Based on the results of the demonstration program, Waste Management of the Desert has now expanded its fleet to include more than 30 CNG trucks. The Company is proceeding with the conversion of its entire Palm Desert collection fleet to natural gas trucks.

Washington, Pennsylvania LNG Demonstration Project: In 1997, Waste Management's hauling division in Washington, Pennsylvania teamed with a consortium of public and private organizations to test and evaluate seven 100% dedicated LNG refuse trucks. Each of the LNG trucks has been used to provide daily urban collection service, and a monitoring system has been developed to evaluate performance compared to diesel equipment. All trucks are equipped with Mack E7G 325-hp LNG engines, and two special

LNG fuel tanks with a combined capacity of 150 gallons. A 13,000-gallon on-site fueling system was constructed at the Waste Management facility. The system is capable of dispensing 30 gallons of LNG fuel per minute.

Waste Management's experience with the Mack LNG trucks has been very positive. Performance and reliability have been comparable to the Mack diesels and driver satisfaction is very high. Support from Mack Trucks has been excellent.

New Natural Gas Projects: Although detailed performance and cost evaluations are still underway for both demonstration projects, Waste Management is very encouraged by its actual, in-use experience with natural gas vehicles. The Company is working closely with all of its engine, chassis and body manufacturers to standardize and streamline the installation of CNG fuel tanks on new refuse trucks, and to develop new training programs for drivers and mechanics.

During the next two years, Waste Management will add an estimated 120 to 250 new natural gas trucks throughout California, in Houston, and potentially in other non-attainment areas. The Company will also re-power 45 diesel trucks with CNG or LNG engines, and will construct at least five new on-site natural gas fueling stations.

Air Quality Benefits: Compared to today's conventional diesel trucks, each of the natural gas trucks will greatly reduce harmful air emissions. Smog precursors such as oxides of nitrogen (NOx) will be reduced by approximately 60% and particulate matter (PM) will be reduced by about 60%.

Over the life of the vehicles, Waste Management's natural gas fleet will reduce NOx emissions by 1000 to 2000 tons and PM emissions by 40 to 68 tons – the exhaust emissions equivalent of taking 50,000 to 88,000 new passenger cars off the road.

Planned Locations New Natural Gas Truck Deployment

- Empire Waste Management (Sonoma County)
- G.I. Industries (Ventura County)
- Napa Disposal
- USA Waste of Fresno
- Waste Management of Antelope Valley
- Waste Management of Corona
- Waste Management of the Desert
- Waste Management of Houston
- Waste Management of Moreno Valley
- Waste Management of Orange County
- Waste Management of San Diego
- Waste Management of San Gabriel Valley
- Waste Management of San Jose